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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/719,923	11/21/2003	Bhabendra K. Pradhan	A03168US 15630.142	3351

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EXAMINER	
STADLER, REBECCA M	
ART UNIT	**PAPER NUMBER**
1754	

DATE MAILED: 08/23/2006

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	Application No.	Applicant(s)	
	10/719,923	PRADHAN, BHABENDRA K.	
	Examiner	Art Unit	
	Rebecca M. Stadler	1754	

-- *The MAILING DATE of this communication appears on the cover sheet with the correspondence address* --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE *3* MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☐ Responsive to communication(s) filed on *30 May 2006*.

2a)☒ This action is **FINAL**. 2b)☐ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-20 and 22-24* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☐ Claim(s) _____ is/are rejected.

7)☒ Claim(s) *1-20 and 22-24* is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☒ The drawing(s) filed on *21 November 2003* is/are: a)☒ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☐ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☐ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08) Paper No(s)/Mail Date _____.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ .
5) ☐ Notice of Informal Patent Application (PTO-152)
6) ☐ Other: _____.

Response to Arguments

Applicant's arguments, see Remarks, filed 5/30/2006, with respect to the 112 rejections have been fully considered and are persuasive. The 112 rejections of claims 1, 12, 16, 18 and 20 have been withdrawn.

Applicant's arguments filed 5/30/2006 have been fully considered but they are not persuasive.

In response to applicant's argument that the references fail to show certain features of applicant's invention, it is noted that the features upon which applicant relies (i.e., that the present invention uses an unsupported catalyst, rather than a supported catalyst) are not recited in the rejected claim(s). Although the claims are interpreted in light of the specification, limitations from the specification are not read into the claims. See e.g., In re Van Geuns, 988 F.2d 1181, 26 U.S.P.Q. 2d 1057 (Fed. Cir. 1993).

As to applicant's argument that claims 9 and 14 are not performed in order to prevent graphite formation on the nanotube, a person of ordinary skill in the art at the time of this invention would have recognized that excess hydrogen in the Rodriguez process would have prevented graphite. It is irrelevant that the present invention is performing this step for a different purpose.

Insofar as applicant is arguing unexpected results, applicant is invited to submit such evidence.

Regarding applicant's argument that Takita uses a different carbon-containing gas than Rodriguez, the carbon dioxide of Takita and the carbon monoxide of Rodriguez are so similar that one of ordinary skill in the art would expect that interchanging the two gases would not significantly affect the process.

As to applicant's argument that two hours is greater than 30 minutes, Rodriguez discloses that the reduction is done for an "effective" amount of time. It would have been obvious to one of ordinary skill in the art at the time the invention was made to optimize the time

for reduction, since it has been held that discovering an optimum value or a result effective variable involved only routine skill in the art. See, e.g., In re Boesch, 617 F.2d 272, 205 U.S.P.Q. 215 (CCPA 1980).

Claim Objections

Claim 6 is objected to under 37 CFR 1.75(c), as being of improper dependent form for failing to further limit the subject matter of a previous claim. Applicant is required to cancel the claim(s), or amend the claim(s) to place the claim(s) in proper dependent form, or rewrite the claim(s) in independent form. Claim 6 is actually broader than claim 1. Claim 1 recites a heating step of 30 minutes, while claim 6 recites a heating step of 0 to up to 60 minutes.

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

The factual inquiries set forth in *Graham* **v.** *John Deere Co.*, 383 U.S. 1, 148 USPQ 459 (1966), that are applied for establishing a background for determining obviousness under 35 U.S.C. 103(a) are summarized as follows:

1. Determining the scope and contents of the prior art.
2. Ascertaining the differences between the prior art and the claims at issue.
3. Resolving the level of ordinary skill in the pertinent art.
4. Considering objective evidence present in the application indicating obviousness or nonobviousness.

Claims 1-4, 6-9, 11, 13-20, and 22-24 are rejected under 35 U.S.C. 103(a) as being unpatentable over Rodriguez 6,159,538.

As to claims 1, 6-7, 11, 13, 16,18-20, and 22-24, Rodriguez '538 discloses a method for producing carbon nanofibers by utilizing a catalyst (see column 4, lines 53-56). The catalyst is a metal oxide heated in a hydrogen-containing atmosphere at a temperature from about 400° to 600° C for an effective amount of time (see column 4, line 65 – column 5, line 8). Thereafter, the temperature of the heating zone is raised to from about 500° C to about 700° C (see column 6, lines 47-51). The carbon-containing compound can be carbon monoxide (see column 6, lines 52-55) and it may be desirable to have an effective amount of hydrogen (see column 6, line 66 – column 7, line 12). Although Rodriguez '538 is silent as to the amount of hydrogen, the heating rate, and the effective amount of time for the reduction step, it would have been obvious to optimize these process parameters in order to obtain the best quality catalyst particles. See, e.g., In re Boesch, 617 F.2d 272, 205 U.S.P.Q. 215 (CCPA 1980).

Regarding claims 2-4, Rodriguez teaches using iron oxide (see column 5, lines 46-48 and column 4, lines 65-67, which discloses that the metal is in its oxide form). The reference discloses a first metal selected from Group IB 9 (which includes copper), mixed with a second metal selected from, inter alia, iron (see column 5, lines 46-52). The group IB metal (which includes copper) is present in an amount ranging from 0.5 to 99 %. Overlapping ranges is prima facie evidence of obviousness. See, e.g., In re Malagari, 499 F.2d 1297, 182 U.S.P.Q. 549 (CCPA 1974).

As to claim 8, Rodriguez teaches that the amount of hydrogen present will be from about 5 to 40 vol %, meaning that the CO present is 60 to 95 vol %. These ranges over lap the claimed ranges. As above, overlapping ranges is prima facie evidence of obviousness. See, In re Malagara, supra.

With respect to claims 9 and 14, it would have been obvious to optimize the process parameters such that there is a large excess of hydrogen so as to prevent any graphite from forming on the carbon nanotubes. See, In re Boesch, supra.

As to claims 15 and 17, Rodriguez appears to produce carbon nanofibers within one hour from when the metal oxide catalyst is heated because no step for cooling is disclosed. As

such, it appears that the process (continuously) produces nanofibers immediately after reducing the metal oxide catalyst. Insofar as the limitation of continuous production is met, it would have been obvious to run the Rodriguez process continuously in order to maximize carbon nanofiber output.

Claims 1-4, 6-11, 13-20, and 22-24 are rejected under 35 U.S.C. 103(a) as being unpatentable over Rodriguez 6,159,538 in view of Takita 6,582,674.

As to claims 1, 6-7, 11, 13, 16,18-20, and 22-24, Rodriguez '538 discloses a method for producing carbon nanofibers by utilizing a catalyst (see column 4, lines 53-56). The catalyst is a metal oxide heated in a hydrogen-containing atmosphere at a temperature from about 400° to 600° C for an effective amount of time (see column 4, line 65 – column 5, line 8). Thereafter, the temperature of the heating zone is raised to from about 500° C to about 700° C (see column 6, lines 47-51). The carbon-containing compound can be carbon monoxide (see column 6, lines 52-55) and it may be desirable to have an effective amount of hydrogen (see column 6, line 66 – column 7, line 12). Although Rodriguez '538 is silent as to the amount of hydrogen, the heating rate, and the effective amount of time for the reduction step, it would have been obvious to optimize these process parameters in order to obtain the best quality catalyst particles. See, e.g., In re Boesch, 617 F.2d 272, 205 U.S.P.Q. 215 (CCPA 1980).

Insofar as Rodriguez does not disclose the limitation of 30 minutes, Takita '674 does teach reducing the catalyst in a hydrogen atmosphere at 400° C for 1 hour (see column 6, Fourth Example, lines 35-39). Takita does not disclose that they reduce the catalyst in the metal oxide form; however, it appears that the Takita catalyst would have to be a metal oxide in order for it to be reduced. It would have been obvious to use the one-hour reduction time of Takita for the "effective amount of time" in Rodriguez because Takita demonstrates that the catalyst can be reduced in a short amount of time. It would be beneficial to use as short of a time for the reduction step as possible in order to reduce cost and complexity of the process.

Further, as both Rodriguez and Takita demonstrate that the reduction time is a result effective variable, it would have been obvious to optimize this parameter, since it has been held that discovering an optimum value or a result effective variable involved only routine skill in the art. See, e.g., In re Boesch, 617 F.2d 272, 205 U.S.P.Q. 215 (CCPA 1980).

Regarding claims 2-4, Rodriguez teaches using iron oxide (see column 5, lines 46-48 and column 4, lines 65-67, which discloses that the metal is in its oxide form). The reference discloses a first metal selected from Group IB 9, which includes copper) mixed with a second metal selected from, inter alia, iron (see column 5, lines 46-52). The group IB metal (which includes copper) is present in an amount ranging from 0.5 to 99 %. Overlapping ranges is prima facie evidence of obviousness. See, e.g., In re Malagari, 499 F.2d 1297, 182 U.S.P.Q. 549 (CCPA 1974).

As to claim 8, Rodriguez teaches that the amount of hydrogen present will be from about 5 to 40 vol %, meaning that the CO present is 60 to 95 vol %. These ranges over lap the claimed ranges. As above, overlapping ranges is prima facie evidence of obviousness. See, In re Malagara, supra.

With respect to claims 9 and 14, it would have been obvious to optimize the process parameters such that there is a large excess of hydrogen so as to prevent any graphite from forming on the carbon nanotubes. See, In re Boesch, supra.

With respect to claim 10, Rodriguez does not disclose a production rate. However, Takita, '674 discloses a carbon deposition quantity (which appears to be the same as a production rate) of 2678 g-carbon/kg-cat•h, or 2.678g-carbon/g-cat•h. It would have been obvious to optimize the parameters of Rodriguez in order to obtain the production rate of Takita in order to obtain as much product as possible.

As to claims 15 and 17, Rodriguez appears to produce carbon nanofibers within one hour from when the metal oxide catalyst is heated because no step for cooling is disclosed. As such, it appears that the process (continuously) produces nanofibers immediately after reducing the metal oxide catalyst. Insofar as the limitation of continuous production is met, it would have

been obvious to run the Rodriguez process continuously in order to maximize carbon nanofiber output.

Claims 1-4, 6-9, 11, 13-20, and 22-24 are rejected under 35 U.S.C. 103(a) as being unpatentable over Rodriguez 6,159,538 in view of Ono 6,261,532.

As to claims 1, 6-7, 11, 13, 16,18-20, and 22-24, Rodriguez '538 discloses a method for producing carbon nanofibers by utilizing a catalyst (see column 4, lines 53-56). The catalyst is a metal oxide heated in a hydrogen-containing atmosphere at a temperature from about 400° to 600° C for an effective amount of time (see column 4, line 65 – column 5, line 8). Thereafter, the temperature of the heating zone is raised to from about 500° C to about 700° C (see column 6, lines 47-51). The carbon-containing compound can be carbon monoxide (see column 6, lines 52-55) and it may be desirable to have an effective amount of hydrogen (see column 6, line 66 – column 7, line 12). Although Rodriguez '538 is silent as to the amount of hydrogen, the heating rate, and the effective amount of time for the reduction step, it would have been obvious to optimize these process parameters in order to obtain the best quality catalyst particles. See, e.g., In re Boesch, 617 F.2d 272, 205 U.S.P.Q. 215 (CCPA 1980).

Insofar as Rodriguez does not disclose the limitation of 30 minutes, Ono '532 discloses reducing a Ni/SiO_2 catalyst in hydrogen for two hours, which meets the limitation of "around 10-60" minutes. It would have been obvious to use the shorter reduction time of Ono for the "effective amount of time" in Rodriguez because Ono demonstrates that the catalyst can be reduced in a short amount of time. It would be beneficial to use as short of a time for the reduction step as possible in order to reduce cost and complexity of the process.

Further, as both Rodriguez and Ono demonstrate that the reduction time is a result effective variable, it would have been obvious to optimize this parameter, since it has been held that discovering an optimum value or a result effective variable involved only routine skill in the art. See, e.g., In re Boesch, 617 F.2d 272, 205 U.S.P.Q. 215 (CCPA 1980).

Regarding claims 2-4, Rodriguez teaches using iron oxide (see column 5, lines 46-48 and column 4, lines 65-67, which discloses that the metal is in its oxide form). The reference discloses a first metal selected from Group IB 9, which includes copper) mixed with a second metal selected from, inter alia, iron (see column 5, lines 46-52). The group IB metal (which includes copper) is present in an amount ranging from 0.5 to 99 %. Overlapping ranges is prima facie evidence of obviousness. See, e.g., In re Malagari, 499 F.2d 1297, 182 U.S.P.Q. 549 (CCPA 1974).

As to claim 8, Rodriguez teaches that the amount of hydrogen present will be from about 5 to 40 vol %, meaning that the CO present is 60 to 95 vol %. These ranges over lap the claimed ranges. As above, overlapping ranges is prima facie evidence of obviousness. See, In re Malagara, supra.

With respect to claims 9 and 14, it would have been obvious to optimize the process parameters such that there is a large excess of hydrogen so as to prevent any graphite from forming on the carbon nanotubes. See, In re Boesch, supra.

As to claims 15 and 17, Rodriguez appears to produce carbon nanofibers within one hour from when the metal oxide catalyst is heated because no step for cooling is disclosed. As such, it appears that the process (continuously) produces nanofibers immediately after reducing the metal oxide catalyst. Insofar as the limitation of continuous production is met, it would have been obvious to run the Rodriguez process continuously in order to maximize carbon nanofiber output.

Claim 10 are rejected under 35 U.S.C. 103(a) as being unpatentable over Rodriguez '538 in view of Ono '532, as applied to claim 1 above, and in further view of Takita '674.

With respect to claim 10, Rodriguez does not disclose a production rate. However, Takita, '674 discloses a carbon deposition quantity (which appears to be the same as a production rate) of 2678 g-carbon/kg-cat•h, or 2.678g-carbon/g-cat•h. It would have been

obvious to optimize the parameters of Rodriguez in view of Ono in order to obtain the production rate of Takita in order to obtain as much product as possible.

Claims 5 and 12 are rejected under 35 U.S.C. 103(a) as being unpatentable over Rodriguez '538 as applied to claim 1 above, and further in view of Sun 6,518,218.

Claim 5 and 12 are rejected under 35 U.S.C. 103(a) as being unpatentable over Rodriguez '538 in view of Takita '674 or, in the alternative, in view of Ono '532, as applied to claim 1 above, and in further view Sun 6,518,218.

As to claim 5, Rodriguez discloses oxides of iron, copper, nickel and combinations thereof for the catalyst (see column 5, lines 46-67 and column 4, lines 65-67). However, Rodriguez does not disclose using molybdenum as a catalyst. Sun '218 does disclose using molybdenum as the catalyst (see Abstract). It would have been obvious to use the molybdenum catalyst of Sun in the Rodriguez process (or the Rodriguez in view of Takita process or the Rodriguez in view of Ono process) because Sun teaches that molybdenum is an effective catalyst for carbon nanotube synthesis. It would have been obvious to use any effective catalyst.

As to claim 12, Rodriguez does not disclose balancing the hydrogen with an inert gas. However, Sun does disclose an argon and hydrogen mixture (see column 4, lines 32-42). It would have been obvious to add in an inert gas, such as the argon of Sun, to the Rodriguez process (or the Rodriguez in view of Takita process or the Rodriguez in view of Ono process) in order to prevent oxidation of the catalyst.

Conclusion

Applicant's amendment necessitated the new ground(s) of rejection presented in this Office action. Accordingly, **THIS ACTION IS MADE FINAL**. See MPEP § 706.07(a). Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the date of this final action.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Rebecca M. Stadler whose telephone number is 571-272-5956.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Stanley Silverman can be reached on 571-272-1358. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

Rebecca M. Stadler

COLLEEN P. COOKE
PRIMARY EXAMINER